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El Niño-Southern Oscillation influence on the dust storm activity in Australia: Can the past provide an insight into the future?

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Australia is a major global source region for atmospheric dust. The Australian climate (especially eastern Australian climate) is greatly influenced by the El Niño-Southern Oscillation (ENSO) which is the strongest natural fluctuation of climate on interannual time-scales and also affects climate conditions globally. ENSO is the prime driver of extreme weather events such as drought, flooding, bushfires, dust storms and tropical cyclones and up to 50% of annual rainfall variability in northern and eastern Australia is linked to ENSO. As a result increased dust storm events occur in central eastern Australia during dry El Niño phases of the Southern Oscillation. Large dust storm events remove millions of tonnes of fertile topsoil, which is deposited downwind in continental Australia and far beyond. The Lake Eyre Basin, Channel Country and the Mallee region are the main dust source areas. The research project will investigate the influence of the ENSO on dust storm activity in Australia. This will be achieved through major reanalysis of past climate conditions for the past 150 years or more using the global 'ACRE' project which will reconstruct both upper-air dynamics, surface conditions and then all major dust storm events of the past. The key research questions that will be addressed are: - What were the climatic conditions in the long-term past and have they changed? - What are the drivers of severe dust storm events in Australia? - Will dust storms become more prevalent and has their intensity changed through time? ? Can the reconstruction of the past climate for the past 150 years or more including representation of upper-air dynamics and surface conditions provide an insight into the future? - Is there a relationship between climate change, low frequency climate variability and increased or changing dust storm activity? Australia has one of the most variable rainfall climates in the world and observational and modelling results suggest that more frequent or stronger ENSO events are possible in the future. Drought in Australia is probably the most economically costly climate event and has environmental and social impacts by reducing agricultural output and having social impacts on rural communities. All major continental scale dust storm events have occurred after periods of prolonged drought. The reconstruction of the ENSO history using longer-term meteorological data, historical records, and other proxy data that may otherwise have been available (using the ACRE project outputs) provides a far more lengthy and detailed global picture of past ENSO and other climate variability thereby allowing recent climate variability to be assessed from a long-term "multi-proxy" perspective. The resulting dataset can be used to better understand the range of past, present and future climate variability and the influence these have on the dust storm activity in Australia. In addition the information gained can provide an independent means of verifying climate model simulations. The scientific community is well aware that climate change is happening to some degree and Australia is already starting to experience the effects. In order to employ adaptation and mitigating measures it is necessary to understand the underlying mechanisms responsible for climate change.